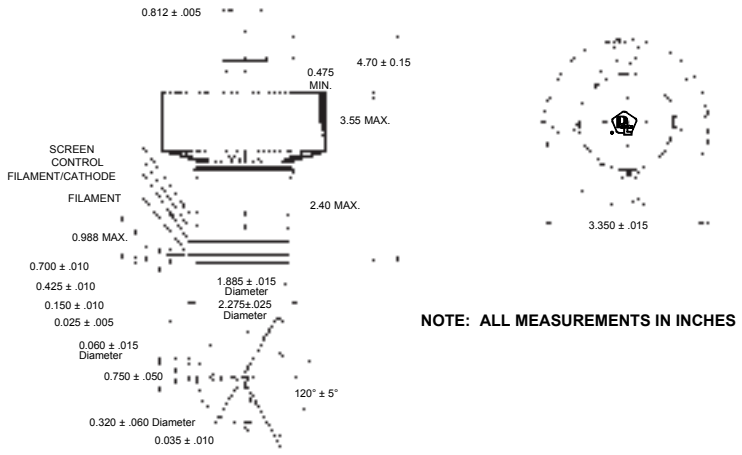

4CX1500BM

Radial-Beam Power Tetrode

The Penta Laboratories 4CX1500BM is radial beam tetrode which is rated for 1500 watts maximum plate dissipation. Construction is metal/ceramic, and cooling is via forced-air.

The high current, low voltage and low distortion design of the 4CX1500BM makes it ideally suited for use in audio amplifier or Class AB_1 RF linear amplifier applications. In addition, the 4CX1500BM exhibits exceptionally low intermodulation distortion and low grid interception for a tube of its power output.

ELECTRICAL CHARACTERISTICS

Cathode-Oxide Coated Unipotential		
Heater Voltage	6.0	volts
Heater Current	10.0	amperes
Minimum Cathode Heating Time	5	minutes
Transconductance (I_b = 0.5 Adc, E_c2 = 225 volts)	30,000	µmhos
Interelectrode Capacitances (In a shielded fixture)		
Grounded-Cathode Circuit Configuration		
Feedback	0.015	pF
Input	81	pF
Output	11.8	pF
Grounded Grid and Screen Circuit Configuration		
Feedback	0.004	pF
Input	38	pF
Output	12	pF
Frequency of Maximum Rating (CW)	110	MHz

MECHANICAL CHARACTERISTICS

Base	Special Locking
Recommended Socket	Penta PL-800
Recommended Chimney	Penta PL-806
Maximum Overall Dimensions	
Length	4.85inches
Diameter	3.50 inches
Net Weight	27.5 ounces
Operating Position	Any
Maximum Operating Temperature of Anode and Ceramic/Metal Seals	250°C

Revised 06/13/00

P E N T A L A B O R A T O R I E S

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(800) 421-4219 * (818) 882-3872 * FAX: (818) 882-3968

COOLING

Sufficient cooling should be provided to the anode and ceramic/metal seals to maintain surface temperatures below the rated maximum temperature of 250°C. It should be noted however, that tube life can often be substantially increased by operating the tube below its rated maximum temperature.

At sea level and with ambient air temperatures up to 35°C, an air-flow of 34.5 CFM with an accompanying pressure drop of 0.65 inches of water will provide adequate cooling for a tube operating at its maximum rated plate dissipation. At higher altitudes, higher ambient air temperature, or when the 4CX1500BM is operated at very high frequencies, increased air flow will be required. For instance, at 10,000 feet above sea level, 45.5 CFM of cooling air and a pressure drop of 0.8 inches of water will be required. When the 4CX1500BM is operated below its maximum rated plate dissipation, substantially less cooling air is required.

When there is uncertainty regarding the required air flow, it should be noted that the sole criterion which can be reliably used for judging cooling effectiveness is tube surface temperature. Tube surface temperature can usually be determined by using any number of temperature sensitive paints currently available.

PLATE DISSIPATION

Under all classes of operation, the maximum plate dissipation allowable for the 4CX1500BM is 1500 watts. During tuning, plate dissipation may be permitted to rise above the stated maximums for brief periods of time.

SCREEN-GRID OPERATION

Under no conditions should the screen dissipation be allowed to exceed 12 watts. In that excessive screen dissipation is likely to result where plate voltage, plate load, or bias voltage are removed, suitable precautions should be taken to avoid these conditions while filament and screen voltages are applied.

Tetrode tubes may on occasion exhibit reversed screen current, and this behavior is prominent in the 4CX1500BM; under certain conditions, negative screen currents approximating 25 milliamperes may be encountered. Regardless of current, screen voltage must be maintained constant. If the screen power supply is such that negative screen current induces increased voltage, it is crucial that some method of stabilization be employed (bleeder resistors, voltage regulator tubes, electron tube regulator circuit, etc).

CONTROL-GRID OPERATION

The 4CX1500BM has an average grid dissipation rating of 1 watt. Grid current for the 4CX1500BM typically approximates 1.0 milliampere or less. Tube life can be extended by maintaining grid bias and driving power at or near the recommended values whenever possible.

INTERMODULATION DISTORTION

The RF Linear Amplifier Typical Operating Conditions and included distortion data are derived from actual operation in a grid driven, neutralized amplifier. Because of its low grid interception, it is possible to drive the 4CX1500BM with the grid positive without the usually associated adverse affects on the driver or distortion levels. Consequently, Class AB_2 linear amplifier operation is possible and recommended. For optimum results, the input to the tube should be swamped with a 1000 X resistor from cathode to grid, and a low impedance drive should be employed in order that the load to the driver be maintained as nearly constant as possible. More detailed information, as well as graphs of IM distortion versus power output are available from The Penta Laboratories upon request.

FILAMENT VOLTAGE

The 4CX1500BM is designed to operate with 6.0 volts applied to the filament. Under no circumstances should filament voltage be allowed to deviate from this value by more than 5%. The useful life of the tube can be extended by adhering to this value as closely as possible.

The cathode and one side of the filament are internally connected.

MAXIMUM RATINGS AND TYPICAL OPER-

NOTE ON TYPICAL OPERATION DATA

The data shown in the following Typical Operation section is calculated or measured based on industry standard published characteristic curves. It is assumed that RF gird voltage is adjusted in order to obtain the the specified plate current, plate voltage, and bias. Under this procedure, little variation in power output will occur when the tube is changed or replaced. Although grid current may vary slightly from tube to tube, it is relevant only in-so-far as it results in the appropriate plate current, and should pose no problem given that the circuit voltage is not allowed to vary with current. If a grid resistor is used as the source of grid bias, it is crucial that this resistor be adjustable so that the required bias voltage may be obtained when the correct RF grid voltage is applied.

ATING CONDITIONS

AF Power Amplifier or Modulator - Class AB_1 Grid Driven (Sinusoidal Wave)

Maximum Ratings

DC Plate Voltage	3000	Volts
DC Screen Voltage	400	Volts
DC Plate Current	0.9	Ampere
Plate Dissipation	1500	Watts
Screen Dissipation	12.0	Watts
Grid Dissipation	1.0	Watts

Typical Operation (Two Tubes)

DC Plate Voltage	2000	2500	2900	Volts
DC Screen Voltage	325	325	325	Volts
Approximate Grid Voltage	-60	-60	-60	Volts
Zero-Signal Plate Current	500	500	500	mAdc
Maximum-Signal Plate Current	1.68	1.69	1.69	Adc
Zero-Signal Screen Current	-30	-25	-20	mAdc
Maximum-Signal Screen Current	-27	-33	-32	mAdc
Plate Power Output	1605	2260	2775	Watts
Plate to Plate Load Resistance	1950	2715	3335	Ω
Driving Power	0	0	0	Watts

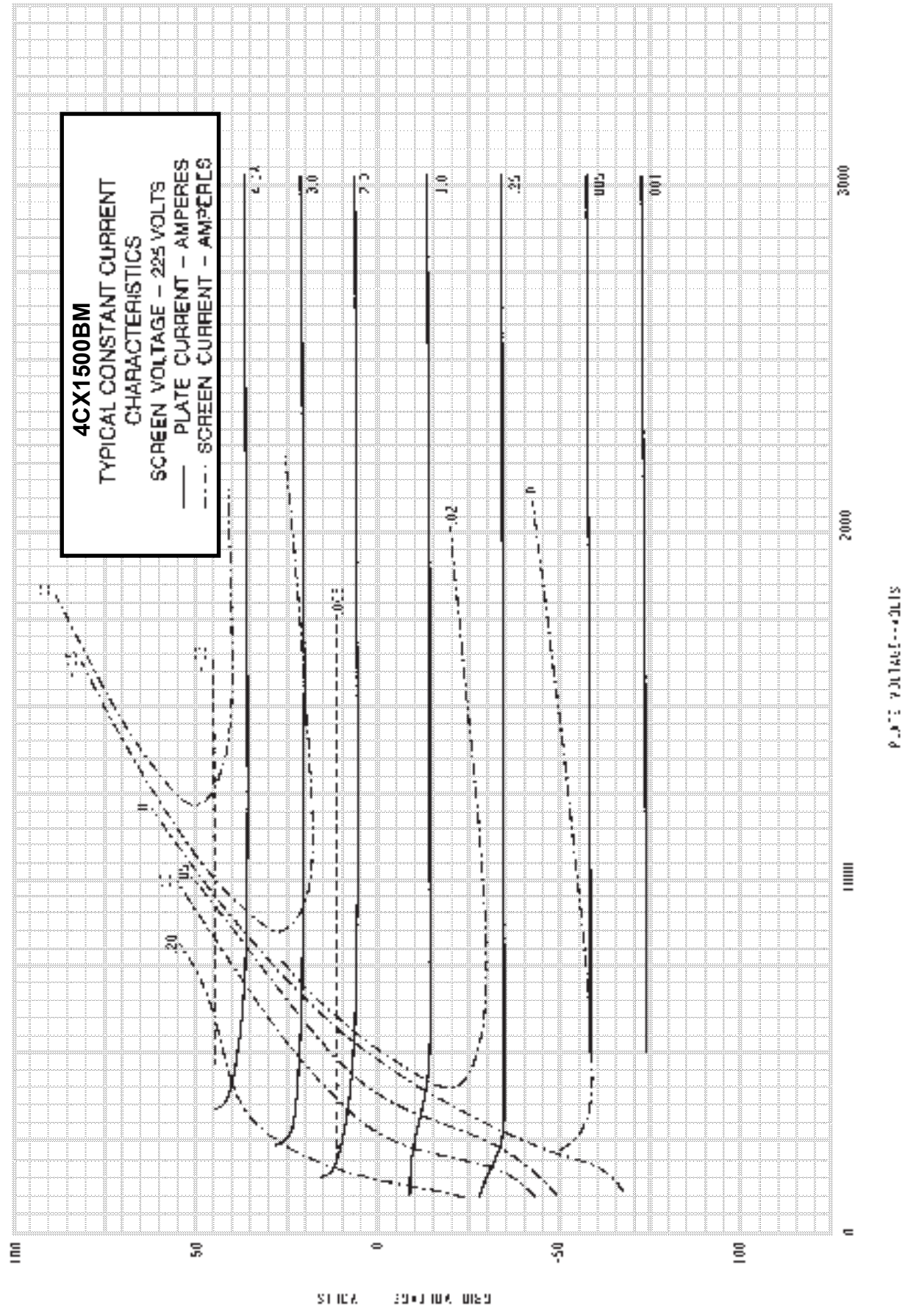
RF Linear Amplifier - Class AB_2 Grid Driven, Modulation Crest or Peak Envelope Conditions

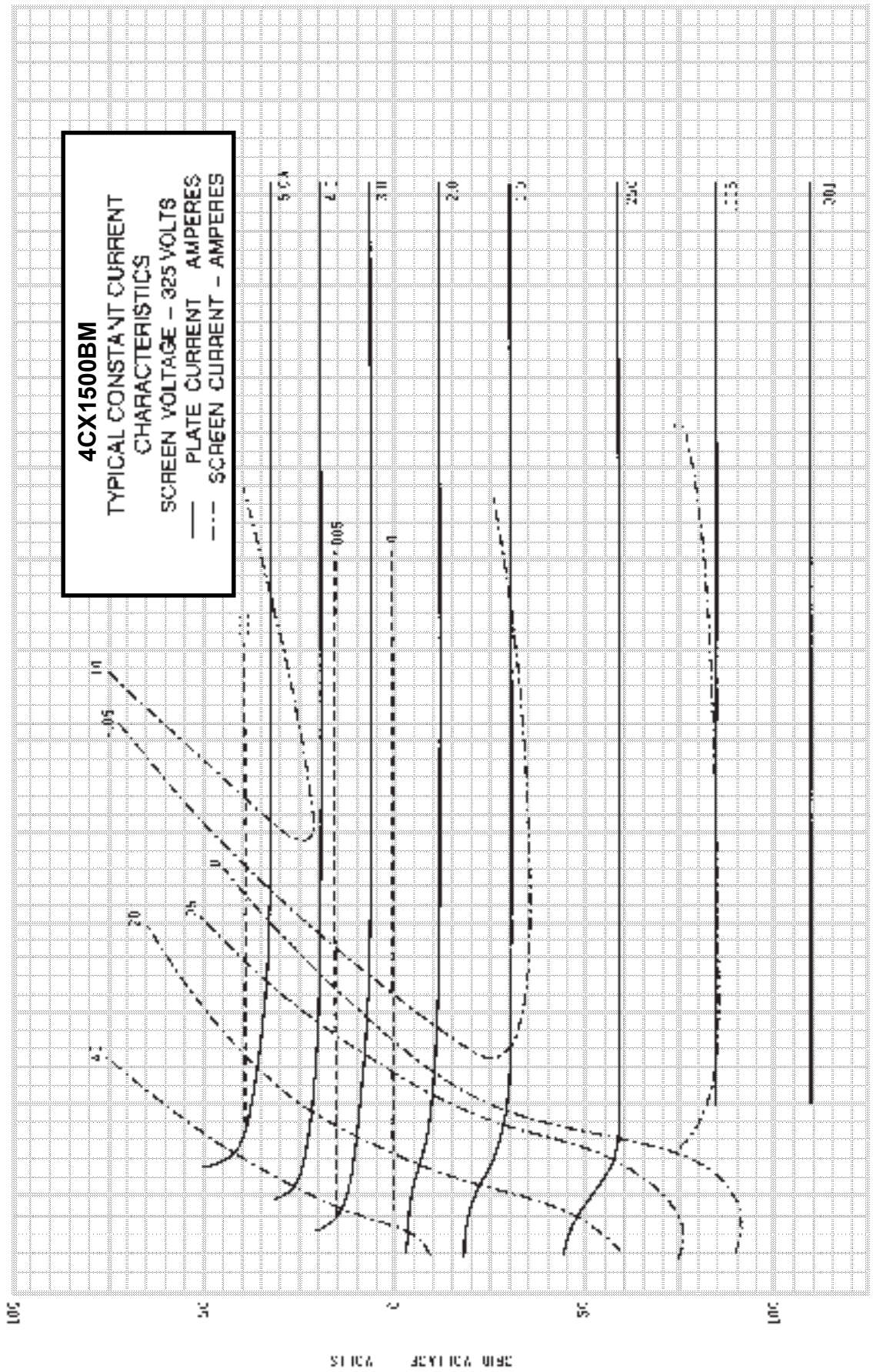
Maximum Ratings

DC Plate Voltage	3000	Volts
DC Screen Voltage	400	Volts
DC Plate Current	0.9	Ampere
Plate Dissipation	1500	Watts
Screen Dissipation	12	Watts
Grid Dissipation	1.0	Watts

Typical Operation (Frequencies Below 30 MHz)

DC Plate Voltage	2500	2750	2900	Volts
DC Screen Voltage	225	225	225	Volts
Grid Voltage	-34	-34	-34	Volts
Zero-Signal Plate Current	300	300	300	mAdc
Approximate Single Tone Plate Current	720	755	710	mAdc
Approximate Two Tone Plate Current	530	555	542	mAdc
Approximate Single Tone Screen Current	-7	-14	-15	mAdc
Approximate Two Tone Screen Current	-11	-11	-11	mAdc
Plate Power Output	900	1100	1100	Watts
Approximate Single Tone Grid Current	1.3	0.95	0.53	mAdc
Approximate Two Tone Grid Current	0.06	0.20	0.06	mAdc
Approximate Single Tone Screen Current	-7	-14	-15	mAdc
Peak RF Grid Voltage	46	45	41	Volts
Driving Power	1.5	1.5	1.5	Watts
Resonant Load Impedance	1900	1900	2200	Ω
Intermodulation Distortion Products				
3rd Order	-38	-40	-43	dB
5th Order	-47	-48	-47	dB


4CX1500BM
TYPICAL CONSTANT CURRENT
CHARACTERISTICS
SCREEN VOLTAGE – 225 VOLTS
PLATE CURRENT – AMPERES
SCREEN CURRENT – AMPERES
4.0
3.0
2.0
1.0
.25
.005
.001
.02
.03
.05
.1
.2
.5
1
2
100
50
0
-50
-100
0
1000
2000
3000


4CX1500BM
TYPICAL CONSTANT CURRENT
CHARACTERISTICS
SCREEN VOLTAGE – 325 VOLTS
PLATE CURRENT – AMPERES
SCREEN CURRENT – AMPERES